

**Mathematics
Pre-Calculus A**

Unit 4: Polynomial and Rational Functions

<p>Essential Understandings</p>	<ul style="list-style-type: none"> ▪ Functions can be used as models for real-life problems. ▪ Functions can be graphed, evaluated, transformed, analyzed, manipulated and combined using algebraic and graphical techniques. ▪ Functions can be used as a prediction tool. ▪ Function work can be simplified using a graphing calculator.
<p>Essential Questions</p>	<ul style="list-style-type: none"> ▪ What are polynomial and rational functions? ▪ How are functions used as a prediction tool for real-life problems? ▪ What are the types of real-life situations where functions can be used as models and prediction tools? ▪ How does the vocabulary of functions apply to the real-life situations they model? ▪ How is a graphing calculator used to work with functions?
<p>Essential Knowledge</p>	<ul style="list-style-type: none"> ▪ Linear functions describe real-life situations where a rate of change remains constant. ▪ Quadratic functions can describe real-life situations involving area, gravity and data analysis. ▪ Cubic polynomial functions can describe real-life situation involving volume and data analysis. ▪ Rational functions can be used to describe real-life situations where ratios of polynomial functions must be used. ▪ Exponential functions can be used to describe growth and decay situations. ▪ Imaginary and complex numbers can be used to model scientific situations where 2-dimensional addition and subtraction are necessary. ▪ Graphing calculators can make the tedious parts of working with functions workable. ▪ Functions can be graphed, evaluated, transformed, analyzed, manipulated, and combined using algebraic and graphical techniques. ▪ Functions can be used a prediction tool. ▪ Function work can be simplified using a graphing calculator.

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<p>Vocabulary</p>	<ul style="list-style-type: none"> ▪ <u>Terms:</u> <ul style="list-style-type: none"> ○ function definitions, domain, range, inputs, outputs, independent and dependent variables, function notation, vertical and horizontal line tests, interval notation – increasing, decreasing and constant intervals, relative minimum and maximum points, symmetry - even and odd functions, rigid and non-rigid function transformations (translations, reflections, rotations and dilations), function operations (add, subtract, multiply, divide and compositions), function inverse, one-to-one functions, linear, quadratic, cubic, piece-wise defined, rational, exponential and logarithmic functions, asymptotes (vertical, horizontal and oblique, standard and general forms of a function, continuous and discontinuous functions (removable, jump and infinite discontinuities), factoring, quadratic formula and synthetic division, the remainder and rational root theorems, real, imaginary and complex solutions, graphing calculator
<p>Essential Skills</p>	<ul style="list-style-type: none"> ▪ Evaluate and graph all types of functions ▪ Write functions using function notation ▪ Decide which type of function to use in a given real-life situation. ▪ Manipulate functions in order to use them as modeling and prediction tools. ▪ Use a graphing calculator appropriately to work with the various types of functions. ▪ Decide when it is appropriate to use real, imaginary and/or complex numbers.
<p>Related Maine Learning Results</p>	<p><u>Mathematics</u> D. Algebra Equations and Inequalities D2.Students solve families of equations and inequalities.</p> <ol style="list-style-type: none"> a. Solve systems of linear equations and inequalities in two unknowns and interpret their graphs. b. Solve quadratic equations graphically, by factoring in cases where factoring is efficient, and by applying the quadratic formula. c. Solve simple rational equations. d. Solve absolute value equations and inequalities and interpret the results. e. Apply the understanding that the solution(s) to equations of the form $f(x) = g(x)$ are x-value(s) of the point(s) of intersection of the graphs of $f(x)$ and $g(x)$ and common outputs in table of values. f. Explain why the coordinates of the point of intersection of the lines represented by a system of equations is its solution

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	and apply this understanding to solving problems.
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	<p>Functions and Relations D4.Students understand and interpret the characteristics of functions using graphs, tables, and algebraic techniques.</p> <ol style="list-style-type: none"> a. Recognize the graphs and sketch graphs of the basic functions. b. Apply functions from these families to problem situations. c. Use concepts such as domain, range, zeros, intercepts, and maximum and minimum values. d. Use the concepts of average rate of change (table of values) and increasing and decreasing over intervals, and use these characteristics to compare functions.
<p style="text-align: center;">Sample Lessons And Activities</p>	<ul style="list-style-type: none"> ▪ Use the graphing calculator to evaluate two related sets of real-life data to decide which type of function to use as a model and a prediction tool.
<p style="text-align: center;">Sample Classroom Assessment Methods</p>	<ul style="list-style-type: none"> ▪ Homework, quiz and chapter exams ▪ Poster project
<p style="text-align: center;">Sample Resources</p>	<ul style="list-style-type: none"> ▪ <u>Publications:</u> <ul style="list-style-type: none"> ○ <u>Advanced Mathematical Concepts</u> ▪ <u>Other Resources:</u> <ul style="list-style-type: none"> ○ Graphing calculator ○ A+ learning system for remediation